

REMARKS

This is intended as a full and complete response to the Office Action dated October 27, 2000. Claims 1-20 were pending in the application and stand rejected. Applicants have canceled claims 2, 5, 7, 15, and 16 without prejudice, and added new claims 21-33 to more clearly recite aspects of the invention.

Claims 1-20 stand rejected under 35 U.S.C. § 112, second paragraph. Applicants have amended the claims to correct matters of form and to obviate the rejections as discussed below.

Regarding claims 2, 7 and 15, the Examiner states that it is unclear what is intended by "a pre-clean chamber". Applicants have canceled the claims to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Regarding claim 1, the Examiner states that the process steps are not commensurate in scope with the preamble. Applicants have amended claim 1 by incorporating the subject matter of claim 5 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Claims 4 and 16 stand objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicants have amended claim 4 and canceled 16 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Regarding claims 6, 11, 12, and 18, the Examiner states that reference to "RF power" and "RF bias" need to "either have an article showing their antecedent basis in part, or they need to be differentiated therefrom". Applicants have amended claims 6, 11, 12, and 18 by adding the appropriate articles as requested by the Examiner to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Regarding claim 10, the Examiner states that the claim is vague and indefinite because it contradicts part (c) of claim 6 which requires "a metal on the patterned dielectric layer". Applicants have amended claims 6 and 10 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Regarding claim 12, the Examiner states that "the inductive coil (lines 3-4) lacks proper antecedent basis due to inconsistent terminology". Applicants have amended

claim 12 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Regarding claims 12 and 18, the Examiner states that "since the units for bias (RF bias) are not Watts, claims 12 and 18 are confusing." Applicants have amended claims 12 and 18 to obviate the rejection. Applicants intended the phrase "RF bias supplied to the substrate support member" to reflect the amount of power needed to bias the support member and thus, quantified RF bias in the units of Watts. Applicants agree with the Examiner that a bias is a voltage differential (volts) and not power (watts). However, the term "watts of RF bias supplied to the substrate support member" is commonly used in the art to refer to the power supplied to bias the substrate support member." Accordingly, Applicants have amended claims 6, 12, and 18 to more clearly recite the invention. As such, Applicants respectfully request withdrawal of the rejection.

Regarding claims 13 and 19, the Examiner states that "each plasma" does not use a proper article for showing antecedent basis. Applicants have amended claims 13 and 19 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Regarding claim 20, the Examiner states that "a pressure" in lines 1 and 2, appear to need differentiating, because they are not the same. Applicants have amended claim 20 to obviate the rejection. Accordingly, Applicants respectfully request withdrawal of the rejection.

Claims 1-11, 13-17 and 19 are rejected under 35 U.S.C § 103(a) as being unpatentable over *Yoo et al.* in view of *Zhao et al.* The Examiner states that *Yoo et al.* teaches two plasma etching steps consisting of a first plasma of argon and a second plasma of helium and a reactive gas such as CF₄ or CF₃H. The Examiner states that *Zhao et al.* teaches an argon plus hydrogen plasma. The Examiner therefore asserts that it would have been obvious to one of ordinary skill in the art that "hydrogen was a reactive gas that could have been used equivalently in the process of *Yoo et al.* ... because it was shown to produce like effects in analogous situations and configurations".

Applicants respectfully traverse the rejection on grounds that the Examiner has not established a case of *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. See, *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Further, the teaching or suggestion to make the claimed invention and the reasonable expectation of success must both be found in the prior art, not in the applicants' disclosure. See M.P.E.P. § 2143, citing *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). Still further, the examiner must *particularly* identify any suggestion, teaching or motivation from within the references to combine the references. See, *In Re Dembiczak*, 50 USPQ2d 1614 (Fed. Cir. 1999). The mere recitation of a combination of references does not amount to particularly identifying a suggestion, teaching, or a motivation to combine the references.

The Examiner has erroneously extracted the use of hydrogen taught by *Zhao et al.* and argued that it would have been obvious to use hydrogen with helium instead of the fluorine-containing compound taught in the process of *Yoo et al.*, even though *Zhao et al.* clearly teaches a plasma of both argon and hydrogen. The Examiner has not particularly identified a motivation or suggestion from within either reference to combine hydrogen of *Zhao et al.* with the two step process of *Yoo et al.* The Examiner has recreated the present invention in light of the applicant's own disclosure which is impermissible hindsight.

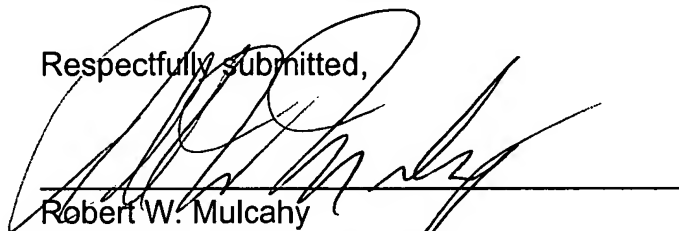
Furthermore, the Examiner's reasoning for combining the reference is not a proper basis for rejection under a 103 obviousness type rejection. The Examiner stated that it would have been obvious to use hydrogen because it was shown to produce like effects in analogous situations and configurations. However, the Examiner has not provided any suggestion, teaching or motivation from within the references to combine their teachings. *Yoo et al.* teaches an argon sputtering process to smooth corners formed within a feature followed by a "soft-etching" process of a carbon tetrafluoride/helium mixture to decrease contact resistance for a nonsilicided device. (See, *Yoo et al.* at col. 4 line 50 through col. 5, line 13.) *Yoo et al.* also teaches that the soft etching plasma is not needed for silicided devices, which teaches away from a two-step process recited in the present claims. (See, *Yoo et al.* at col. 5, line 60.) *Zhao et*

a/. discloses a process for removing material from a device by forming a plasma of argon and hydrogen. The references, alone or in combination, do not teach, show, or suggest cleaning a patterned dielectric layer in a processing chamber with a first plasma comprising predominantly argon and cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium, as recited in claims 1, 6, 14, and those dependent therefrom. Accordingly, Applicants respectfully request withdrawal of the rejection and allowance of the claims.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the claimed invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



Robert W. Mulcahy
Registration No. 25,436
APPLIED MATERIALS, INC.
3050 Bowers Avenue
Santa Clara, CA 95054
Telephone: (713) 623-4844
Facsimile: (713) 623-4846

Attorney for Applicant(s)

APPENDIX

1. (Amended) A method for improving metal deposition on a patterned dielectric layer, comprising:

- a) cleaning the patterned dielectric layer in a processing chamber with a first plasma comprising predominantly argon; [and]
- b) cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium; and
- c) depositing a metal on the patterned dielectric layer after exposing the dielectric layer to the first plasma and the second plasma.

4. (Amended) The method of claim 1, wherein the second plasma consists essentially of [from] about 5% [to about 100% of] hydrogen by number of atoms and [from about 0% to] about 95% [of] helium by number of atoms.

6. (Amended) A method for improving metal deposition on a patterned dielectric layer on a substrate, comprising:

- a) cleaning the patterned dielectric layer in a processing chamber with a first plasma comprising predominantly argon, wherein the first plasma is generated by supplying a RF power to a coil surrounding the processing chamber and supplying a RF power to bias [to] a substrate support member supporting the substrate;
- b) cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium, wherein the second plasma is generated by supplying the RF power to the coil surrounding the processing chamber and supplying the RF power to bias [to] the substrate support member supporting the substrate; and
- c) depositing a metal [on the patterned dielectric] layer after exposing the dielectric layer to the first plasma and the second plasma.

9. (Amended) The method of claim 6, wherein the second plasma consists essentially of about 5% hydrogen by number of atoms and about 95% [of] helium by number of atoms.

10. (Amended) The method of claim 6, further comprising depositing a barrier layer [on the patterned dielectric layer] prior to depositing the metal layer.

11. (Amended) The method of claim 6, wherein the [less] RF power [bias is] supplied to bias the substrate support member and [to] generate the second plasma is less than [is] the RF power supplied to bias the substrate support member and [to] generate the first plasma.

12. (Amended) The method of claim 6, wherein the first plasma is generated with about 300 W of the RF power supplied to the coil and about 300 W of the RF power [bias] supplied to bias the substrate support member, and the second plasma is generated with about 450 W of the RF power supplied to the [inductive] coil and about 10 W of the RF power [bias] supplied to bias the substrate support member.

13. (Amended) The method of claim 6, wherein each [plasma is] of the first plasma and the second plasma are maintained in the processing chamber for about 60 seconds.

14. (Amended) A method for improving metal deposition on a patterned dielectric layer on a substrate, comprising:

a) cleaning the patterned dielectric layer in a processing chamber with a first plasma consisting essentially of argon, wherein the first plasma is generated by supplying a RF power to a coil surrounding the processing chamber and supplying a RF power to bias [to] a substrate support member supporting the substrate;

b) cleaning the patterned dielectric layer in the processing chamber with a second plasma consisting essentially of hydrogen and helium, wherein the second plasma is generated by increasing the supply of the RF power to the coil surrounding the processing chamber and reducing the supply of the RF power to bias [to] the substrate support member supporting the substrate;

- c) depositing a barrier layer on the patterned dielectric layer after exposing the dielectric layer to the first plasma and the second plasma; and
- d) depositing a metal on the barrier layer.

18. (Amended) The method of claim 14, wherein the first plasma is generated with about 300 W of the RF power supplied to the coil and about 300 W of the RF power [bias] supplied to bias the substrate support member, and the second plasma is generated with about 450 W of the RF power supplied to the coil and about 10 W of the RF power [bias] supplied to bias the substrate support member.

19. (Amended) The method of claim 14, wherein each [plasma is] of the first plasma and the second plasma are maintained in the processing chamber for about 60 seconds.

20. (Amended) The method of claim 14, wherein the first plasma is generated at [a pressure in the processing chamber of] about 0.8 mtorr, and the second plasma is generated at [a pressure in the processing chamber of] about 80 mtorr.